4. Results

Table 1: Descriptive Statistics

	Mean	Std. Deviation	N
SL	1.4118	10.73891	240
NIFTY500	-1.0931	7.34663	240
SMB	.6927	3.79639	240
HML	.6922	4.73546	240
CMA	.1947	3.16196	240
RMW	.8774	3.44476	240
WML	1.6557	6.61594	240

Table 2: Multi-Collinearity Table

	NIFTY500	**SMB**	**HML**	**CMA**	**RMW**
SMB	.057				
HML	.136	.310			
CMA	.057	-.294	-.650		
RMW	-.524	-.293	-.509	.395	
WML	-.329	-.090	-.295	.107	.385

A quick test for multi-collinearity does not reveal any significant evidence to suggest that the independent variables are correlated to each other. The broader market proxy, in this case the NIFTY500, appears to be poorly correlated with the Size effect, and that is along expected lines. The correlation between the Market and the Value effect is twice of what is observed between the Market and the Size effect, although the correlation between the former two factors still tends to be poor. It is also observed that the correlation coefficient between the Market and the Investment effect is the same as that between the Market and the Size effect. Interestingly, the correlation coefficients between the Market and Profitability effect especially, and between the Market and Momentum effect, even though are negative, are much higher in magnitude. This becomes especially significant in light of the fact that the average returns for the Profitability effect are only second to the mean returns for the Momentum effect. These observations would be suggestive of a contrarian inclination in the behavior of these two factors in relation to the broader market movements.

Even though there is no apparent collinearity between the Size effect and the Value effect, however, the coefficient of correlation between the two is not only positive but comparatively higher. This observation seemingly suggests that usually, small-sized firms also tend to be undervalued at times. The correlation between the Size effect and the Investment effect is negative, suggesting that small-sized firms are generally not found to be conservative in their approach towards investment in assets. Similarly, the presence of a negative correlation coefficient of a similar magnitude between the Size and the Profitability effects indicate that small-sized firms also tend to have lower profitability. However, it is important to note that the correlation coefficients between neither of these factors can be considered as strong. The correlation coefficient between the Size effect and the Momentum effect is almost close to zero, alluding to the absence of any relationship between the two factors.

The coefficient of correlation observed between the Value effect and the Investment effect is also observed to be negative and on the higher side. A similar observation is recorded in the case of the Value and the Profitability effects. These observations would indicate an inclination of undervalued firms to be less conservative in their approach towards investing in assets. It would also suggest that undervalued firms tend to be less profitable in comparison to their overvalued peers. A negative correlation is also observed between the Value and Momentum effects.

The correlation coefficient found between the Investment and Profitability effect would suggest that conservative firms may tend to be among the more profitable firms as well. However, the magnitude of the correlation coefficient indicates that this conclusion might not have strong grounds for conviction. Similarly, the observed value for the Karl Pearson's correlation coefficient would suggest that conservative firms do not have a significant momentum effect.

The study observes a positive correlation between the Profitability and Momentum effect, although the magnitude of the observation does not suggest a strong correlation, it does indicate that the more profitable firms might also be found to have a significant momentum effect behind them.

CAPM

Table 3: Investment-Sorted Portfolios

Portfolio	Alpha-intercept	Beta Coefficient	t-value Alpha	T-value Beta	Adjusted R squared
P1	.00117	.795	.276	20.214	.630
P2	.00750	.814	1.86	21.652	.662
P3	.00767	.814	1.939	21.618	.661
P4	.00689	.848	2.028	24.695	.718
P5	.00536	.845	1.652	24.386	.713
P6	.00642	.854	2.079	25.362	.729
P7	.00737	.884	2.706	29.214	.781
P8	.00582	.867	1.977	26.793	.750
P9	.00607	.898	2.189	31.415	.805
P10	.01018	.880	3.007	28.635	.774

Table 4: Market Cap-Sorted Portfolios

Portfolio	Alpha-intercept	Beta Coefficient	t-value Alpha	T-value	Adjusted R squared
P1	.01688	.721	3.120	16.036	.517
P2	.00936	.763	1.984	18.186	.580
P3	.00708	.801	1.666	20.623	.640
P4	.00650	.817	1.642	21.835	.666
P5	.00632	.836	1.716	23.481	.697
P6	.00353	.857	1.053	25.689	.734
P7	.00420	.885	1.427	29.378	.783
P8	.00293	.895	1.065	30.883	.799
P9	-.00073	.927	-.350	38.018	.858
P10	.00021	.971	.177	62.366	.942

Table 5: Profitability-Sorted Portfolios

Portfolio	Alpha-intercept	Beta Coefficient	T-value Aplha	T-value	Adjusted R squared
P1	.00287	.829	.666	22.849	.686
P2	.00585	.822	1.418	22.286	.675
P3	.00716	.855	1.894**	25.476	.731
P4	.00454	.831	1.217	23.054	.689
P5	.00591	.845	1.704**	24.415	.713
P6	.00547	.825	1.547	22.505	.679
P7	.00663	.870	2.354*	27.253	.756
P8	.00689	.881	2.608*	28.723	.775
P9	.00914	.893	3.738*	30.575	.796
P10	.00990	.885	3.710*	29.391	.783

Table 6: Value-Sorted Portfolios

Portfolio	Alpha-intercept	Beta Coefficient	T-value Aplha	T-value	Adjusted R squared
P1	.01349	.735	2.450	16.746	.539
P2	.00954	.783	2.119	19.397	.611
P3	.00866	.814	2.154	21.629	.661
P4	.00789	.816	2.042	21.817	.665
P5	.00608	.856	1.847	25.588	.732
P6	.00721	.864	2.223	26.496	.746
P7	.00210	.888	.748	29.863	.788
P8	.00179	.892	.659	30.523	.796
P9	.00005	.907	.019	33.266	.822
P10	-.00081	.928	-.402	38.531	.861

Table 7: Momentum-Sorted Portfolios

Portfolio	Alpha-intercept	Beta Coefficient	T-Value Alpha	T-value	Adjusted R squared
P1	-.00339	.758	-.611	17.944	.573
P2	.00158	.716	.338	15.843	.511
P3	.00529	.728	1.299	16.383	.528
P4	.00693	.738	1.732	16.855	.542
P5	.00873	.740	2.226	16.995	.546
P6	.00983	.727	2.559	16.356	.527
P7	.00971	.708	2.449	15.469	.499
P8	.01120	.714	2.921	15.728	.508
P9	.01265	.676	3.033	14.170	.455
P10	.01494	.598	2.922	11.511	.355

Tables 3 to 7 present regression results of the single-factor CAPM. The returns of single-sorted portfolios have been regressed against the mean-excess broader market returns, and some of the results are very interesting. Even though the CAPM is able to adequately explain the average returns on all but one of the ten portfolios formed on the basis of market capitalization, it fails to perform sufficiently when applied to portfolios formed on factors other than market cap. This interpretation is supported by the argument that a model that has significant explanatory powers will have an Alpha-intercept that will be very close to zero. The results show that the CAPM especially falls short in explaining average returns on portfolios P1 sorted on Investment, P1 sorted on Market Cap and P1 sorted on the Value factor as well. It is important to note that there are other portfolios sorted on the basis of the aforementioned factors

that have statistically significant Alpha-values as well, however, I have chosen to highlight results for portfolios that have an Alpha-intercept greater than .009. The results reveal a great deal about how the investors perceive stocks of certain companies. The results provide testimony to the presence of size and value factor, with the portfolio of the smallest-size companies by way of market cap generally being companies that also tend to have the highest value as measured by the PB ratio. Additionally, the results also present a strong argument against the strength of the CAPM in explaining returns of companies that are aggressively reinvesting their earnings to acquire new assets, as evidenced by the significant outperformance of the portfolio P10 formed on the Investment factor. It has commonly been observed that small-size, high value companies also tend to invest aggressively in assets, thus one may infer that a majority of the companies comprising the single-sorted portfolios P1 formed on market cap, P1 formed on the basis of value factor and P10 formed on the basis of the Investment factor might overlap. However, the most interesting results were observed when single-sorted portfolios formed on the basis of the Momentum factor were regressed against the market returns. Three portfolios, namely P8, P9 and P10, the ones that had the strongest momentum effects in their favor, also had statistically significant Alpha values of greater than .009, implying that the single-factor CAPM was especially inept at explaining momentum returns. The values of the adjusted R squared are also indicative of the aforementioned inability of the single-factor Capital Asset Pricing-model. These results stand to confirm previous literature which has found the CAPM inadequate in explaining excess portfolio returns.

Fama-French Three-Factor model

$$R_{pt} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_{it}$$

Table 8: Investment-sorted Portfolios

Portfolio	Alpha	Beta1	Beta2	Beta3	T-valueA	T-value1	T-value2	T-value3	Adjusted R^2
P1	-.00975	.749	.387	.172	-3.520	29.490	14.596	6.462	.849
P2	-.00339	.766	.355	.208	-1.345	33.116	14.729	8.572	.875
P3	-.00338	.763	.358	.227	-1.458	35.037	15.800	9.916	.889
P4	-.00112	.813	.324	.119	-.457	33.248	12.722	4.626	.860
P5	-.00250	.803	.272	.197	-1.065	32.471	10.556	7.589	.857
P6	-.00670	.820	.293	.132	-.288	32.905	11.305	5.043	.854
P7	.00101	.851	.254	.137	.500	38.306	10.973	5.856	.884
P8	-.00053	.834	.250	.136	-.229	33.011	9.509	5.129	.850
P9	.00081	.878	.254	.037	.356	38.111	10.575	1.547	.876
P10	.00560	.876	.301	-.093	2.016*	35.211	11.599	-3.564	.855

Table 9: Market Cap-Sorted Portfolios

Portfolio	Alpha	Beta1	Beta2	Beta3	T-ValueA	T-value1	T-value2	T-value3	Adjusted R^2
P1	.00063	.664	.554	.183	.277	35.504	28.402	9.298	.918
P2	-.00426	.713	.502	.157	-1.838	35.154	23.766	7.398	.904
P3	-.00510	.753	.442	.167	-2.310	37.858	21.347	8.008	.907
P4	-.00403	.775	.409	.134	-1.683	34.748	17.611	5.703	.883
P5	-.00261	.799	.346	.127	-1.011	32.465	13.477	4.903	.858
P6	-.00385	.823	.260	.147	-1.466	31.951	9.690	5.429	.845
P7	-.00078	.861	.177	.106	-.297	32.500	6.416	3.812	.835
P8	-.00102	.874	.141	.090	-.398	32.845	5.101	3.217	.834
P9	-.00270	.915	.070	.059	-1.314	38.533	2.843	2.383	.868
P10	.00003	.969	.002	.013	.025	61.499	.092	.759	.942

Table 10: Profitability-Sorted Portfolios

Portfolio	Alpha	Beta1	Beta2	Beta3	T-ValueA	T-value1	T-value2	T-value3	Adjusted R^2
P1	-.00858	.785	.359	.172	-3.149	34.747	15.248	7.260	.880
P2	-.00466	.778	.337	.184	-1.670	31.606	13.120	7.118	.858
P3	-.00230	.820	.338	.121	-.903	36.770	14.556	5.184	.883
P4	-.00509	.788	.335	.180	-2.055	33.354	13.619	7.256	.869
P5	-.00248	.807	.308	.154	-.995	32.965	12.088	5.975	.859
P6	-.00276	.785	.305	.167	-1.044	29.078	10.861	5.875	.829
P7	.00003	.834	.261	.155	.013	35.629	10.686	6.290	.871
P8	.00114	.852	.265	.100	.555	36.281	10.834	4.072	.871
P9	.00442	.872	.263	.040	2.230	37.381	10.810	1.629	.872
P10	.00625	.878	.274	-.064	2.751	34.762	10.393	-2.418	.850

Table 11: Value-Sorted Portfolios

Portfolio	Alpha	Beta1	Beta2	Beta3	T-Value	T-value1	T-value2	T-value3	Adjusted R^2
P1	-.00339	.673	.486	.258	-1.416	35.750	24.793	13.080	.917
P2	-.00377	.724	.398	.267	-1.638	35.597	18.770	12.499	.903
P3	-.00297	.762	.384	.220	-1.374	38.240	18.461	10.506	.907
P4	-.00240	.771	.367	.183	-.983	33.094	15.124	7.480	.873
P5	-.00177	.820	.298	.142	-.741	34.261	11.952	5.639	.866
P6	-.00006	.832	.287	.114	-.026	34.048	11.282	4.428	.860
P7	-.00330	.863	.219	.095	-1.395	34.943	8.508	3.682	.857
P8	-.00222	.881	.243	-.016	-.939	34.977	9.250	-.617	.851
P9	-.00238	.902	.176	-.037	-1.037	35.596	6.658	-1.358	.849
P10	-.00178	.935	.160	-.113	-.965	42.703	7.036	-4.921	.888

Table 12: Momentum-Sorted Portfolios

Portfolio	**Alpha**	**Beta1**	**Beta2**	**Beta3**	**T-ValueA**	**T-value1**	**T-value2**	**T-value3**	**Adjusted R^2**
P1	-.01398	.724	.320	.122	-2.988	20.619	8.741	3.300	.711
P2	-.00808	.666	.263	.264	-2.112	18.274	6.923	6.912	.689
P3	-.00356	.675	.266	.281	-1.106	19.503	7.368	7.722	.719
P4	-.00133	.690	.275	.233	-.407	19.550	7.465	6.274	.708
P5	.00068	.695	.282	.218	.211	19.688	7.679	5.882	.708
P6	.00227	.682	.271	.220	.703	18.521	7.064	5.675	.682
P7	.00200	.663	.285	.213	.596	17.393	7.178	5.319	.659
P8	.00469	.681	.301	.119	1.389	17.160	7.290	2.860	.631
P9	.00659	.647	.282	.096	1.712	14.895	6.236	2.112	.557
P10	.01054	.589	.281	-.051	2.128	11.874	5.435	-.988	.423

In contrast, when regressing the returns of the same single-sorted portfolios against the Fama-French Three-Factor model, it is found that some portfolios that were previously found to have statistically significant outperformance when tested in the CAPM are unable to display the same when their returns are regressed against the Fama-French three factors. In other instances where portfolios that still manage to outperform the Three-factor model, the values of the Alpha-intercept are lower than those observed for the same portfolios when regressed against the single-factor model. For a single-sorted portfolios based on the Investment factor, the portfolio P10, comprising of companies that are most aggressively investing in assets, has a

statistically significant Alpha-intercept. This implies that the portfolio has managed to outperform the model. However, the outperformance, as measured by the Alpha-intercept, pales when compared with that of the same portfolio when tested against the CAPM, suggesting that the Fama-French Three-factor model at least does a better job than the CAPM in explaining excess portfolio returns. Similarly, portfolios P9 and P10, comprising of the most profitable listed firms, still manage to outperform the Three-factor model, as evident by the statistically significant Alpha-intercept. However, the Alpha generated by these portfolios is lesser than that generated by the same portfolios when regressed against the CAPM. The tests show that FF Three-Factor model does a great job in explaining excess returns for portfolios formed on the basis of size and value. Yet, for portfolios formed on the momentum factor, it is found that the portfolio P10, having the strongest momentum effect, still manages to retain its statistically significant Alpha from before.

Carhart Four-factor model

$$R_{pt} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_{it} + \beta_3 MOM_{it} + \varepsilon_{it}$$

Table 13: Investment-Sorted Portfolio

Portfolio	Alpha	Beta1	Beta2	Beta3	Beta4	T-ValueA	T-value1	T-value2	T-value3	T-value4	Adjusted R^2
P1	-.0059	.706	.388	.135	-.148	-2.206	28.155	15.570	5.183	-5.679	.866
P2	-.0003	.731	.356	.178	-.119	-.129	31.560	15.475	7.412	-4.944	.886
P3	-.0008	.733	.359	.201	-.100	-.374	33.288	16.420	8.819	-4.359	.897
P4	.00167	.779	.325	.089	-.117	.685	31.580	13.280	3.476	-4.583	.871
P5	.00030	.766	.273	.165	-.124	.128	30.879	11.074	6.430	-4.825	.869
P6	.00225	.781	.294	.098	-.132	.991	31.413	11.931	3.807	-5.135	.869
P7	.00273	.828	.255	.116	-.079	1.333	36.242	11.230	4.917	-3.352	.889
P8	.00239	.795	.251	.102	-.134	1.045	31.511	10.036	3.897	-5.111	.865
P9	.00358	.843	.255	.007	-.118	1.601	36.551	11.122	.292	-4.954	.887
P10	.00909	.837	.301	-.127	-.131	3.329	33.711	12.231	-4.935	-5.101	.869

Table 14: Market Cap-Sorted Portfolio

Portfolio	Alpha	Beta1	Beta2	Beta3	Beta4	T-Value	T-value1	T-value2	T-value3	T-value4	Adjusted R^2
P1	.00263	.644	.554	.165	-.069	1.138	33.533	29.074	8.301	-3.454	.922
P2	-.0016	.684	.503	.133	-.096	-.725	33.446	24.747	6.276	-4.503	.911
P3	-.0026	.725	.443	.143	-.095	-1.185	36.151	22.259	6.881	-4.575	.914
P4	-.0009	.740	.410	.103	-.120	-.414	33.290	18.597	4.466	-5.215	.895
P5	.00079	.759	.346	.092	-.136	.311	31.057	14.289	3.625	-5.383	.873
P6	-.0006	.784	.261	.113	-.130	-.266	30.376	10.179	4.239	-4.875	.858
P7	.00324	.811	.178	.062	-.171	1.292	31.522	6.982	2.334	-6.411	.859
P8	.00299	.823	.143	.045	-.175	1.225	31.957	5.581	1.683	-6.573	.859
P9	.00014	.874	.071	.024	-.138	.071	37.330	3.064	.984	-5.7	.883
P10	.00159	.944	.002	-.009	-.084	1.318	60.099	.131	-.557	-5.166	.947

Table 15: Profitability-sorted portfolios

Portfolio	Alpha	Beta1	Beta2	Beta3	Beta4	T-Value	T-value1	T-value2	T-value3	T-value4	Adjusted R^2
P1	-.0053	.751	.360	.143	-.114	-1.979	33.154	15.99	6.094	-4.846	.891
P2	-.0005	.733	.338	.145	-.152	-.209	30.471	14.134	5.816	-6.111	.877
P3	.0005	.789	.339	.095	-.103	.197	35.019	15.145	4.065	-4.418	.892
P4	-.0019	.750	.336	.147	-.127	-.795	31.888	14.386	6.050	-5.206	.882
P5	.00071	.768	.309	.120	-.132	.292	31.504	12.778	4.742	-5.224	.874
P6	.00105	.737	.307	.124	-.164	.414	27.840	11.674	4.541	-5.983	.851
P7	.00226	.803	.261	.128	-.105	1.083	33.849	11.099	5.196	-4.279	.880
P8	.00350	.819	.266	.071	-.114	1.724	34.613	11.328	2.906	-4.651	.881
P9	.00646	.843	.264	.014	-.101	3.263	35.530	11.197	.565	-4.125	.880
P10	.00856	.847	.274	-.092	-.108	3.766	32.937	10.756	-3.458	-4.063	.859

Table 16: Value-Sorted Portfolios

Portfolio	**Alpha**	**Beta1**	**Beta2**	**Beta3**	**Beta4**	**T-ValueA**	**T-value1**	**T-value2**	**T-value3**	**T-value4**	**Adjusted R^2**
P1	-.0012	.652	.487	.240	-.072	-.510	33.796	25.428	12.030	-3.577	.921
P2	-.0008	.692	.398	.239	-.109	-.374	34.131	19.806	11.388	-5.185	.913
P3	-.0004	.733	.384	.195	-.098	-.204	36.592	19.312	9.384	-4.738	.915
P4	.00152	.724	.368	.142	-.158	.659	32.325	16.549	6.141	-6.787	.893
P5	.0011	.784	.299	.110	-.124	.499	32.725	12.579	4.431	-5.006	.878
P6	.00349	.789	.288	.075	-.149	1.471	32.911	12.124	3.043	-5.986	.878
P7	-.0000	.821	.220	.058	-.144	-.010	33.694	9.097	2.319	-5.709	.874
P8	.00184	.827	.244	-.063	-.182	.834	34.625	10.286	-2.553	-7.356	.879
P9	.00090	.857	.177	-.076	-.153	.407	34.460	7.162	-2.957	-5.926	.868
P10	-.0011	.925	.161	-.122	-.033	-.590	40.325	7.059	-5.120	-1.383	.888

Table 17: Momentum-Sorted Portfolios

Portfolio	**Alpha**	**Beta1**	**Beta2**	**Beta3**	**Beta4**	**T-Value**	**T-value1**	**T-value2**	**T-value3**	**T-value4**	**Adjusted R^2**
P1	-.0028	.620	.322	.031	-.353	-.726	21.011	10.996	1.011	-11.547	.815
P2	-.0041	.619	.264	.224	-.157	-1.088	16.726	7.177	5.845	-4.092	.708
P3	-.0026	.663	.266	.270	-.040	-.805	18.254	7.377	7.190	-1.064	.719
P4	-.0010	.686	.275	.229	-.014	-.302	18.473	7.454	5.958	-.365	.706
P5	-.0015	.725	.282	.245	.104	-.478	19.843	7.766	6.467	2.741	.716
P6	-.0008	.726	.270	.257	.148	-.246	19.281	7.235	6.610	3.781	.699
P7	-.0024	.726	.284	.268	.214	-.753	19.207	7.567	6.847	5.454	.696
P8	-.0022	.781	.299	.207	.342	-.744	21.860	8.433	5.599	9.241	.728
P9	-.0020	.768	.280	.202	.412	-.632	20.406	7.487	5.190	10.556	.698
P10	-.0029	.756	.277	.094	.568	-.779	19.868	7.344	2.398	14.393	.692

Interesting results are observed when regressing the mean excess returns of single-sorted portfolios against the Carhart Four-Factor model. The aforementioned model is essentially a Fama-French Three-Factor model that has a Momentum factor added to it. Unlike previous observations, single-sort portfolios formed on the basis of the momentum effect fail to show a statistically significant value for the Alpha-intercept. This would suggest that the addition of a Momentum factor to the three already included in the Fama-French model helps to account for the outperformance of momentum portfolios observed previously. Similarly, portfolios formed on the basis of the Size and the Value effect also fail to outperform the model. However, it is

still important to note that for single-sorted portfolios formed on the basis of the investment factor, the portfolio P10, consisting of companies that have been the most aggressive in enlarging their asset size, the model still fails to explain the outperformance of the particular portfolio. Likewise, for single-sorted portfolios P9 and P10, formed on the basis of the profitability factor, the Alpha-intercept is still statistically significant; thereby implying that the Four-Factor model is unable to explain the excess returns for portfolios comprising of the most profitable companies and for portfolios consisting of companies that have displayed the most aggressive approach towards asset acquisition. However, the values of the adjusted R squared indicate that both the Fama-French Three-Factor model and the Carhart Four-Factor model do a far better job than the CAPM in explaining mean excess returns for portfolios.

Fama-French 5 Factor Model

$$R_{pt} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + + \beta_4 CMA_t + \beta_5 RMW_t + \varepsilon_{it}$$

Table 18: Investment-Sorted Portfolios

Portfolio	α	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
P1	-.0023	.710	.350	.013	-.163	-.13	-.88	25.122	14.377	.406	-5.194	-4.25	.877
P2	.00174	.735	.330	.100	-.106	-.10	.677	27.158	14.142	3.250	-3.524	-3.264	.888
P3	.00064	.731	.338	.145	-.070	-.09	.267	28.151	15.122	4.913	-2.441	-3.084	.897
P4	.00095	.752	.313	.106	.053	-.11	.368	25.393	12.294	3.144	1.608	-3.431	.866
P5	-.0007	.802	.262	.146	-.065	-.02	-.29	26.385	10.009	4.243	-1.920	-.660	.858
P6	.00050	.796	.287	.114	.003	-.05	.199	25.847	10.811	3.258	.094	-1.405	.854
P7	.00105	.827	.254	.153	.050	-.03	.479	30.164	10.765	4.925	1.630	-1.185	.885
P8	-.0003	.790	.249	.160	.081	-.06	-.12	25.602	9.374	4.575	2.363	-1.916	.854
P9	-.0011	.838	.265	.120	.154	-.03	-.48	30.860	11.321	3.900	5.088	-1.197	.887
P10	.00482	.786	.305	-.01	.210	-.12	1.78	28.146	12.672	-.302	6.780	-3.929	.880

Table 19: Market Cap-Sorted Portfolios

Portfolio	A	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
P1	.00502	.625	.534	.112	-.05	-.10	2.129	28.242	28.064	4.442	-1.936	-3.994	.925

P2	.00106	.649	.477	.074	-.04	-.15	.457	27.824	23.754	2.798	-1.400	-5.597	.917
P3	-.0024	.722	.429	.123	-.02	-.07	-1.039	29.809	20.592	4.466	-.849	-2.669	.910
P4	-.0034	.730	.407	.151	.074	-.07	-1.351	26.870	17.392	4.894	2.464	-2.399	.887
P5	-.0003	.758	.334	.095	.004	-.09	-.110	25.152	12.858	2.768	.130	-2.493	.861
P6	-.0010	.777	.245	.104	-.00	.101	-.367	24.725	9.066	2.903	-.123	-2.789	.849
P7	.00092	.794	.168	.106	.076	-.12	.333	24.789	6.091	2.913	2.122	-3.257	.843
P8	.00146	.802	.128	.070	.057	-.13	.541	25.010	4.630	1.934	1.595	-3.765	.842
P9	-.0014	.883	.063	.043	.016	-.06	-.671	30.172	2.495	1.306	.477	-1.917	.869
P10	.00025	.963	.000	.009	.001	-.01	.188	49.254	.000	.396	.068	-.522	.941

Table 20: Profitability-Sorted Portfolios

Portfolio	**α**	**β1**	**β2**	**β3**	**β4**	**β5**	**T α**	**T1**	**T2**	**T3**	**T4**	**T5**	**Adj. R^2**
P1	-.0005	.677	.323	.064	-.02	-.24	-.198	28.050	15.556	2.348	-.650	-8.69	.911

P2	.00115	.696	.309	.101	-.01	-.18	.409	24.367	12.575	3.114	-.457	-5.603	.875
P3	.00339	.694	.312	.073	.080	-.24	1.427	29.154	15.205	2.717	3.038	-9.024	.913
P4	-.0013	.741	.316	.113	-.03	-.11	-.493	26.087	12.905	3.497	-1.092	-3.447	.876
P5	.00015	.752	.295	.121	.021	-.11	.055	25.304	11.512	3.599	.621	-3.293	.865
P6	-.0007	.750	.295	.135	-.00	-.08	-.269	22.575	10.297	3.577	-.043	-1.989	.831
P7	-.0005	.828	.264	.176	.034	-.00	-.228	28.554	10.571	5.333	1.058	-.051	.871
P8	-.0008	.886	.277	.139	.011	.078	-.388	30.795	11.192	4.253	.356	2.360	.873
P9	.00153	.912	.281	.106	.042	.099	.732	32.344	11.587	3.315	1.331	3.047	.878
P10	.00336	.920	.291	-.00	.031	.099	1.392	29.942	11.004	-.128	.911	2.816	.855

Table 21: Value-Sorted Portfolios

Portfolio	**α**	**β1**	**β2**	**β3**	**β4**	**β5**	**T α**	**T1**	**T2**	**T3**	**T4**	**T5**	**Adj. R^2**

P1	.00169	.617	.465	.188	-.03	-.13	.693	28.176	24.645	7.550	-1.19	-5.17	.926
P2	-.0011	.684	.385	.230	-.00	-.09	-.46	27.659	18.087	8.206	-.083	-3.06	.906
P3	-.0022	.743	.380	.213	.013	-.04	-.93	30.125	17.872	7.613	.480	-1.32	.907
P4	.00096	.710	.350	.138	.010	-.13	.375	25.388	14.532	4.336	.325	-4.00	.880
P5	.00071	.784	.285	.099	-.01	-.08	.278	26.769	11.295	2.973	-.453	-2.48	.868
P6	.00112	.799	.281	.105	.026	-.06	.421	26.523	10.834	3.061	.771	-1.82	.861
P7	-.0018	.821	.211	.083	.031	-.08	-.72	27.089	8.077	2.414	.924	-2.30	.859
P8	-.0000	.812	.231	-.03	.060	-.13	-.03	26.771	8.833	-.877	1.787	-3.73	.859
P9	.00024	.851	.160	-.08	.002	-.11	.098	27.609	6.045	-2.28	.066	-3.13	.854
P10	.00044	.882	.146	-.15	.014	-.11	.225	33.344	6.430	-4.93	.479	-3.61	.893

Table 22: Momentum-Sorted Portfolios

Portfolio	**A**	**β1**	**β2**	**β3**	**β4**	**β5**	**T α**	**T1**	**T2**	**T3**	**T4**	**T5**	**Adj. R^2**

P1	-.0049	.576	.284	.040	.061	-.30	-1.063	14.373	8.213	.871	1.358	-6.51	.753
P2	-.0029	.542	.237	.217	.079	-.24	-.738	12.584	6.387	4.442	1.660	-4.93	.716
P3	-.0010	.610	.251	.253	.037	-.12	-.308	14.404	6.894	5.252	.792	-2.64	.725
P4	.00265	.607	.252	.173	.017	-.17	.766	14.224	6.848	3.573	.358	-3.56	.720
P5	.00525	.616	.256	.136	-.01	-.17	1.548	14.487	6.979	2.810	-.378	-3.61	.723
P6	.00470	.613	.256	.192	.043	-.13	1.361	13.601	6.606	3.756	.857	-2.62	.688
P7	.00457	.631	.269	.154	-.04	-.08	1.268	13.436	6.658	2.893	-.771	-1.51	.662
P8	.00797	.632	.281	.047	-.03	-.11	2.204	12.989	6.699	.857	-.706	-2.11	.637
P9	.00955	.610	.264	.030	-.04	-.09	2.304	11.392	5.734	.500	-.737	-1.53	.560
P10	.01353	.559	.265	-.11	-.04	-.08	2.531	9.109	5.015	-1.61	-.662	-1.14	.423

When the single-sorted portfolios are regressed against the Fama-French Five-Factor model, it is found that except for portfolios sorted on the momentum effect, the model is sufficiently able to explain the mean excess returns. The only exceptions to the aforementioned observations is a portfolio of the smallest companies by way of market cap, P1, which has statistically significant outperformance as measured by the Alpha-intercept; and the portfolio P10, which comprises of companies which have shown the most aggressive asset growth, although the Alpha-intercept is only statistically significant when using the 10 % confidence interval.

However, on the whole, the observed values of the adjusted R squared strongly suggest that the FF five-factor model can be considered as robust in explaining excess portfolio returns. However, the same conclusion cannot be drawn for the model when testing it against portfolios sorted using the momentum effect. For single-sorted momentum portfolios P8, P9 and P10, the Alpha-intercept is not only statistically significant but its value, especially for the momentum portfolio P10, is similar to the ones observed for the same portfolios when tested against the CAPM and the Fama-French Three-Factor model. Therefore, it would suffice to say that the Fama-French Five-Factor model fails to explain the excess returns of portfolios formed on the basis of the momentum effect.

Modified Five-Factor Model

$$R_{pt} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 CMA_t + \beta_4 RMW_t + \beta_5 MOM_{it} + \varepsilon_{it}$$

Table 23: Investment-Sorted Portfolios

Portfolio	A	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
P1	.00017	.686	.352	-.17	-.10	-.14	.072	25.799	15.632	-6.86	-3.35	-6.08	.894
P2	.00623	.715	.338	-.16	-.09	-.13	2.611	27.145	15.159	-6.44	-3.09	-5.51	.896
P3	.00595	.714	.350	-.15	-.10	-.11	2.552	27.200	15.744	-5.97	-3.32	-4.95	.897
P4	.00508	.734	.322	-.00	-.11	-.11	2.072	25.024	12.981	-.071	-3.38	-4.53	871
P5	.00446	.779	.274	-.14	-.02	-.14	1.886	26.006	10.804	-5.05	-.588	-5.60	.866
P6	.00486	.773	.296	-.05	-.04	-.14	2.091	25.778	11.667	-2.00	-1.15	-5.47	865
P7	.00553	.813	.266	-.03	-.05	-.09	2.572	28.789	11.140	-1.15	-1.60	-3.86	.881
P8	.00503	.768	.262	-.00	-.06	-.14	2.130	24.994	10.083	-.078	-1.99	-5.41	858
P9	.00338	.819	.275	.091	-.03	-.12	1.537	30.568	12.114	3.661	-1.11	-5.31	893
P10	.00625	.768	.305	.216	-.09	-.10	2.471	28.263	13.245	8.543	-3.04	-4.38	889

Table 24: Market Cap-Sorted Portfolios

Portfolio	A	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
P1	.00949	.614	.543	-.10	-.11	-.07	4.126	27.147	28.393	-5.03	-4.32	-3.82	.923
P2	.00450	.635	.483	-.07	-.14	-.09	2.053	27.574	24.797	-3.49	-5.55	-4.49	.921
P3	.00240	.706	.440	-.09	-.08	-.10	1.066	29.085	21.386	-3.84	-2.80	-4.98	.912
P4	.00230	.710	.419	-.00	-.07	-.12	.949	26.143	18.223	-.160	-2.55	-5.48	.890
P5	.00410	.736	.342	-.04	-.07	-.13	1.609	25.220	13.842	-1.65	-2.17	-5.49	.872
P6	.00335	.755	.254	-.06	-.09	-.13	1.283	24.561	9.755	-2.03	-2.59	-4.99	.858
P7	.00575	.767	.177	.021	-.10	-.17	2.284	25.152	6.865	.730	-2.90	-6.33	.861
P8	.00534	.774	.134	.021	-.11	-.17	2.198	25.612	5.246	.730	-3.21	-6.30	.863
P9	.00108	.860	.067	-.01	-.04	-.14	.539	30.824	2.839	-.262	-1.16	-5.60	.883
P10	.00136	.949	.001	-.00	.010	-.08	1.110	50.569	.077	-.166	.498	-5.14	.947

Table 25: Profitability-Sorted Portfolios

Portfolio	α	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
P1	.00293	.661	.329	-.05	-.23	-.09	1.236	27.970	16.415	-2.30	-8.68	-4.60	.916
P2	.00617	.672	.318	-.07	-.17	-.14	2.390	24.553	13.71	-2.63	-5.48	-6.10	.888
P3	.00664	.681	.318	.042	-.24	-.08	2.942	28.737	15.826	1.917	-9.13	-3.86	.916
P4	.00344	.720	.325	-.09	-.10	-.13	1.417	25.930	13.825	-3.60	-3.35	-5.44	.884
P5	.00498	.731	.305	-.04	-.11	-.13	2.014	25.048	12.337	-1.57	-3.22	-5.32	.872
P6	.00475	.722	.306	-.07	-.06	-.17	1.825	22.616	11.320	-2.41	-1.70	-6.28	.847
P7	.00478	.809	.278	-.06	-.01	-.13	2.171	27.403	11.133	-2.09	-.341	-5.03	.869
P8	.00376	.864	.289	-.06	.082	-.14	1.829	30.597	12.085	-2.31	2.601	-5.84	.881
P9	.00516	.891	.290	-.01	.107	-.13	2.648	32.332	12.428	-.521	3.460	-5.29	.886
P10	.00480	.899	.291	.034	.135	-.12	2.152	30.185	11.557	1.218	4.041	-4.56	.867

Table 26: Value-Sorted Portfolios

Portfolio	α	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
P1	.00875	.606	.480	-.13	-.16	-.08	3.459	25.378	23.727	-5.70	-5.82	-4.07	.915
P2	.00706	.665	.404	-.12	-.11	-.13	2.814	25.017	17.925	-4.94	-3.69	-5.72	.894
P3	.00511	.725	.397	-.10	-.06	-.12	2.156	27.628	17.844	-4.00	-1.99	-5.45	.897
P4	.00673	.684	.362	-.06	-.12	-.16	2.880	25.551	15.940	-2.46	-3.94	-6.99	.893
P5	.00485	.763	.293	-.07	-.07	-.13	2.041	26.709	12.118	-2.48	-2.24	-5.20	.878
P6	.00581	.774	.290	-.03	-.05	-.15	2.400	26.854	11.886	-1.06	-1.42	-6.18	.875
P7	.002	.798	.218	-.01	-.06	-.14	.861	27.424	8.860	-.438	-1.84	-5.72	.873
P8	.00143	.784	.229	.076	-.07	-.16	.642	27.661	9.562	2.901	-2.37	-6.43	.880
P9	.00023	.827	.155	.044	-.05	-.13	.101	27.531	6.097	1.589	-1.54	-4.87	.865
P10	-.0025	.880	.135	.091	-.07	.003	-1.257	31.289	5.673	3.497	-2.25	.129	.882

Table 27: Momentum-Sorted Portfolios

Portfolio	**α**	**β1**	**β2**	**β3**	**β4**	**β5**	**T α**	**T1**	**T2**	**T3**	**T4**	**T5**	**Adj. R^2**
P1	.00240	.521	.289	.041	-.22	-.32	.658	15.881	10.385	1.332	-5.90	-11.16	.839
P2	.00470	.519	.254	-.03	-.26	-.15	1.225	11.837	6.855	-.821	-5.22	-4.068	.712
P3	.00516	.604	.271	-.09	-.18	-.06	1.478	13.410	7.104	-2.25	-3.55	-1.520	.696
P4	.00659	.608	.265	-.07	-.22	-.02	1.923	13.705	7.063	-1.78	-4.34	-.449	.705
P5	.00673	.637	.265	-.09	-.24	.104	2.055	14.804	7.280	-2.22	-5.04	2.790	.722
P6	.00684	.641	.270	-.06	-.23	.138	2.045	13.995	6.968	-1.35	-4.44	3.458	.686
P7	.00518	.669	.280	-.12	-.18	.198	1.537	14.542	7.184	-2.84	-.182	.198	.683
P8	.00462	.694	.282	-.06	-.23	.347	1.559	16.596	7.966	-1.64	-4.96	9.557	.738
P9	.00484	.684	.264	-.06	-.22	.416	1.480	15.449	7.045	-1.48	-4.53	10.817	.706
P10	.00240	.660	.252	.012	-.22	.591	.660	15.077	6.807	.297	-4.55	15.525	.713

According to Fama-French (2015), including the Profitability factor in the pricing model renders the Value factor as obsolete. Therefore, as an experiment, the Value factor is removed. At the same time, the Momentum factor is added to the model. Thus, even though portfolio returns are still regressed against a model containing five factors, however, the factors are not all the same as the ones in the Fama-French Five-Factor model. What is observed is extremely

fascinating. It is found that for single-sorted portfolios formed on the basis of the Investment factor, almost all the portfolios show a statistically significant Alpha-intercept. Similarly, most of the portfolios formed using the Profitability factor also outperform the model at a statistically significant level. Moreover, portfolios P1 & P2, formed on the basis of market capitalization and which consist of the smallest listed companies, also outperform the model at a statistically significant level. Additionally, it is found that single-sort value portfolios consisting of high value companies, and even those comprising of those companies that have been classified as being neutral from a value perspective, show a statistically significant Alpha-intercept. However, the model is able to explain most of the excess returns for momentum portfolios.

Six-Factor model

$$R_{pt} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 CMA_t + \beta_5 RMW_t + \beta_6 MOM_{it} + \varepsilon_{it}$$

Table 28: Investment-Sorted Portfolios

P	A	β1	β2	β3	β4	β5	β6	T α	T1	T2	T3	T4	T5	T6	Adj. R^2
P1	.00079	.686	.354	-.02	-.18	-.10	-.14	.308	25.767	15.60	-.734	-6.17	-3.43	-6.10	.894
P2	.00427	.715	.332	.072	-.12	-.07	-.11	1.709	27.437	14.97	2.399	-4.18	-2.50	-5.01	.898
P3	.00269	.715	.340	.121	-.08	-.07	-.09	1.127	28.176	15.766	4.189	-2.94	-2.40	-4.23	.904
P4	.00305	.734	.316	.080	.040	-.09	-.10	1.188	25.299	12.792	2.418	1.245	-2.78	-4.04	.874
P5	.00172	.780	.265	.115	-.08	.006	-.13	.703	26.620	10.631	3.426	-2.50	.186	-4.98	.871
P6	.00294	.774	.290	.082	-.01	-.02	-.13	1.208	26.059	11.470	2.412	-.401	-.585	-4.96	.868
P7	.00242	.814	.256	.135	.040	-.02	-.07	1.106	29.894	11.040	4.333	1.338	-.646	-3.10	.889
P8	.00202	.769	.252	.130	.065	-.04	-.12	.831	25.727	9.915	3.791	1.980	-1.14	-4.74	.866
P9	.00106	.819	.267	.093	.140	-.01	-.11	.466	31.148	11.944	3.101	4.812	-.407	-4.72	.896
P10	.00727	.768	.308	-.04	.197	-.10	-.10	2.720	28.276	13.306	-1.17	6.565	-3.24	-4.53	.890

Table 29: Market Cap-Sorted Portfolios

P	A	β1	β2	β3	β4	β5	β6	T α	T1	T2	T3	T4	T5	T6	Adj. R^2
P1	.00650	.614	.536	.097	-.05	-.08	-.06	2.756	27.964	28.658	3.848	-2.27	-3.460	-3.127	.928
P2	.00294	.635	.479	.054	-.05	-.13	-.08	1.279	27.780	24.618	2.067	-1.84	-4.984	-4.042	.922
P3	-.0004	.707	.432	.101	-.03	-.05	-.09	-.183	29.903	21.458	3.726	-1.31	-1.97	-4.313	.916
P4	-.0010	.711	.409	.124	.060	-.05	-.11	-.418	27.048	18.302	4.116	2.082	-1.637	-4.772	.897
P5	.00244	.736	.337	.063	-.01	-.06	-.13	.910	25.372	13.645	1.894	-.374	-1.697	-5.059	.874
P6	.00146	.756	.248	.073	-.02	-.07	-.12	.534	24.756	9.554	2.104	-.584	-2.068	-4.533	.860
P7	.00407	.767	.172	.067	.056	-.08	-.16	1.538	25.314	6.666	1.941	1.666	-2.403	-5.879	.862
P8	.00459	.774	.132	.031	.037	-.10	-.16	1.784	25.606	5.122	.893	1.096	-2.926	-6.015	.863
P9	.00086	.860	.066	.010	-.00	-.03	-.13	.402	30.766	2.784	.326	-.044	-1.052	-5.427	.883
P10	.00160	.949	.002	-.01	-.01	.00	-.08	1.234	50.490	.136	-.569	-.446	.356	-5.143	.947

Table 30: Profitability-Sorted Portfolios

P	A	β1	β2	β3	β4	β5	β6	T α	T1	T2	T3	T4	T5	T6	Adj. R^2
P1	.00164	.662	.325	.043	-.029	-.221	-.09	.655	28.071	16.213	1.583	-1.09	-8.127	-4.230	.917
P2	.00424	.672	.313	.068	-.031	-.153	-.13	1.564	24.766	13.516	2.182	-1.05	-4.885	-5.627	.890
P3	.00503	.682	.313	.056	.071	-.230	-.07	2.122	28.954	15.634	2.076	2.746	-8.489	-3.423	.917
P4	.00123	.721	.319	.084	-.049	-.085	-.12	.486	26.286	13.650	2.666	-1.63	-2.702	-4.903	.887
P5	.00263	.731	.298	.092	.005	-.085	-.12	1.020	25.428	12.156	2.787	.166	-2.558	-4.767	.876
P6	.00240	.723	.299	.096	-.022	-.039	-.16	.881	22.925	11.126	2.652	-.624	-1.086	-5.746	.851
P7	.00141	.810	.267	.149	.021	.023	-.10	.631	28.600	11.061	4.614	.661	.693	-4.267	.880
P8	.00139	.865	.281	.108	-.005	.107	-.13	.653	31.309	11.934	3.412	-.151	3.36	-5.210	.886
P9	.00350	.892	.284	.078	.027	.125	-.11	1.716	32.708	12.237	2.494	.903	3.971	-4.778	.889
P10	.00558	.899	.294	-.03	.016	.127	-.12	2.367	30.179	11.601	-1.02	.475	3.708	-4.670	.867

Table 31: Value-Sorted Portfolios

P	α	β1	β2	β3	β4	β5	β6	T α	T1	T2	T3	T4	T5	T6	Adj. R^2
P1	.00320	.607	.466	.173	-.03	-.11	-.0	1.310	27.88	25.15	6.961	-1.51	-4.6	-3.06	.929
P2	.00120	.667	.388	.205	-.01	-.06	-.1	.503	27.88	19.04	7.514	-.571	-2.3	-4.81	.914
P3	-.0000	.727	.382	.190	.001	-.01	-.1	-.028	30.31	18.721	6.917	.040	-.56	-4.55	.914
P4	.00405	.685	.354	.102	-.00	-.09	-.1	1.673	26.14	15.852	3.396	-.286	-3.1	-6.31	.897
P5	.00310	.764	.288	.070	-.03	-.05	-.1	1.242	26.93	11.921	2.149	-.947	-1.7	-4.73	.880
P6	.00405	.775	.285	.069	.008	-.03	-.1	1.594	27.06	11.688	2.116	.242	-.91	-5.70	.877
P7	.00081	.798	.214	.049	.014	-.05	-.1	.330	27.50	8.679	1.488	.434	-1.5	-5.35	.874
P8	.00313	.783	.235	-.07	.039	-.09	-.2	1.342	27.87	9.823	-2.23	1.258	-2.8	-6.79	.882
P9	.00286	.826	.164	-.11	-.01	-.08	-.1	1.222	28.31	6.561	-3.44	-.488	-2.3	-5.54	.871
P10	.00077	.879	.147	-.15	.012	-.10	-.0	.385	32.81	6.444	-4.99	.394	-3.4	-.817	.893

Table 32: Momentum-Sorted Portfolios

P	α	β1	β2	β3	β4	β5	β6	T α	T1	T2	T3	T4	T5	T6	Adj. R^2
P1	.0037	.521	.292	-.04	.020	-.23	-.32	.971	15.877	10.443	-1.07	.546	-5.98	-11.16	.839
P2	-.0002	.520	.240	.186	.063	-.21	-.13	-.05	12.203	6.614	3.814	1.348	-4.37	-3.383	.728
P3	-.0006	.606	.252	.247	.034	-.12	-.02	-.18	14.127	6.899	5.033	.725	-2.50	-.611	.724
P4	.00249	.609	.252	.175	.018	-.18	.009	.703	14.065	6.826	3.543	.378	-3.54	.222	.719
P5	.00288	.638	.252	.167	-.00	-.20	-.13	.850	15.178	7.048	3.482	-.035	-4.24	3.466	.735
P6	.00166	.643	.252	.235	.065	-.17	.172	.489	14.640	6.745	4.674	1.332	-3.46	4.432	.711
P7	.00051	.670	.264	.211	-.01	-.13	.229	.149	15.066	6.956	4.141	-.233	-2.61	5.825	.703
P8	.00167	.695	.271	.138	.008	-.20	.368	.541	16.883	7.745	2.925	.175	-4.25	10.090	.746
P9	.00176	.685	.253	.138	.011	-.20	.436	.518	15.686	6.818	2.757	.227	-3.85	11.293	.714
P10	.00156	.660	.250	.034	.030	-.216	.596	.403	15.064	6.692	.673	.613	-4.274	15.352	.712

When the single-sorted portfolios are regressed against a six-factor model which consists of the five factors from the Fama-French Five-factor model plus an additional momentum factor, it is found that the model is able to explain a significant portion of the excess returns on almost all of the portfolios, with a few exceptions. The portfoliosP9 and P10, consisting of the most profitable companies, still manage to outperform the model at statistically significant levels of 10 percent and 5 percent confidence intervals respectively. Similarly, amongst portfolios formed on the basis of the Investment factor, the portfolio P10 also has a statistically significant Alpha-intercept. For portfolios formed on the basis of Size, the portfolio P1, consisting of the smallest companies by way of market cap, also outperforms the model at a statistically significant level. However, the Six-factor model does a great job of explaining the excess returns for all the portfolios formed on the basis of the Momentum factor, and all but one of the portfolios formed on the basis of the Value factor.

After regressing returns for single-sorted portfolios, the study then proceeds with testing the different asset-pricing models, those which are in contemporary use as well as those suggested by this study, against the mean-excess returns of double-sorted portfolios formed on the basis of the factors size-investment, size-value and size-profitability. The study then goes a step further and also tests the same models against portfolios formed on the basis of the size-momentum factors.

CAPM

Table 33: Size-Investment Sorted Portfolios

Portfolio	Alpha-intercept	Beta Coefficient	t-value Alpha	T-value Beta	Adjusted R squared
S/C	.0087	.767	1.865	18.440	.587
S/M	.0098	.805	2.457	20.898	.646
S/A	.0126	.820	3.126	22.069	.670
B/C	.0022	.879	.737	28.445	.772
B/M	.0026	.911	1.170	34.052	.829
B/A	.0027	.933	1.253	39.932	.870

Table 34: Size-Profitability Sorted Portfolios

Portfolio	Alpha-intercept	Beta Coefficient	T-value Alpha	T-value Beta	Adjusted R squared
S/W	.0070	.803	1.560	20.786	.643
S/M	.0010	.783	2.422	19.433	.612
S/R	.0168	.799	4.262	20.480	.636
B/W	.0018	.904	.614	32.562	.816
B/M	.0010	.906	.431	33.083	.821
B/R	.0042	.933	2.302	39.862	.869

Table 35: Size-Value Sorted Portfolios

Portfolio	Alpha-intercept	Beta Coefficient	T-value Aplha	T-value	Adjusted R squared
S/L	.0049	.814	1.191	21.625	.661
S/M	.0080	.812	2.066	21.474	.658
S/H	.0136	.765	2.863	18.321	.583
B/L	.0002	.938	.121	41.755	.879
B/M	.0038	.896	1.399	31.060	.801
B/H	.0078	.826	1.933	22.567	.680

Table 36: Size-Momentum Sorted Portfolios

Portfolio	**Alpha-intercept**	**Beta Coefficient**	**T-value Aplha**	**T-value**	**Adjusted R squared**
S/L	-.0004	.770	-.104	18.633	.592
S/W	.0198	.637	3.859	12.754	.403
B/L	.0019	.747	.430	17.321	.556
B/W	.0081	.693	2.172	14.840	.478

Regressing double-sorted portfolios against the single-index CAPM yields results that presents the model in a much better light when compared to the results of regressing the single-sorted portfolios against the same. For the portfolios sorted on the size-investment factors, the portfolios S/C (small size companies with a conservative approach towards investment), S/M (small size companies with a moderate growth in assets) and S/A (small size companies with an aggressive approach towards investment) show statistically significant Alpha-intercept at 10 percent confidence-interval for the first and at 5 percent confidence-interval for the latter two portfolios. For portfolios sorted on the basis of size and profitability factors, the portfolios S/M (small size companies with moderate profitability), S/R (small size companies with robust profit margins) and B/R (big companies with robust profits) outperform the model at statistically significant levels. When portfolios are sorted for size and value factors, it is found that small sized portfolios having moderate value and high value, namely S/M and S/H, show a statistically-significant Alpha-intercept at the 5 percent confidence interval while the portfolio B/H, comprising of big-sized companies having high value, also show a statistically significant Alpha-intercept, albeit at the 10 percent confidence interval. The study also finds that for portfolios sorted on size and momentum factors, the portfolios for the winners of both small cap companies and large cap companies, S/W and B/W outperform the single-factor CAPM at statistically significant levels as well. Additionally, when mean-excess returns of the

size-momentum portfolios are regressed against the CAPM, the single-index model also shows a comparatively lower value of the adjusted R squared. This would imply that even though the CAPM does a good job in explaining the returns of the double-sorted portfolios formed on all the other factors, it falls short when used to elucidate upon the returns of the portfolios formed on size and momentum.

Fama-French Three-Factor model

$$R_{pt} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_{it}$$

Table 37: Size-Investment Sorted Portfolios

Portfolio	Alpha	Beta1	Beta2	Beta3	T-value	T-value1	T-value2	T-value3	Adjusted R^2
S/C	-.0053	.711	.481	.208	-2.556	38.658	25.085	10.741	.921
S/M	-.0013	.761	.453	.046	-.641	37.713	21.564	6.277	.905
S/A	.0024	.785	.425	.078	.977	34.157	17.742	3.250	.876
B/C	-.0037	.841	.125	.225	-1.494	33.608	4.800	8.540	.853
B/M	-.0010	.885	.101	.151	-.530	37.542	4.107	6.098	.870
B/A	.0008	.930	.144	-.043	.412	42.457	6.290	-1.867	.887

Table 38: Size-Profitability Sorted Portfolios

Portfolio	Alpha	Beta1	Beta2	Beta3	T-Value	T-value1	T-value2	T-value3	Adjusted R^2
S/W	-.0060	.756	.463	.148	-2.765	41.001	24.057	7.660	.920
S/M	-.0019	.733	.460	.177	-.897	35.975	21.649	8.267	.903

S/R	.0065	.760	.445	.101	2.744	32.441	18.251	4.126	.871
B/W	-.0034	.874	.114	.170	-1.353	36.855	4.616	6.821	.868
B/M	-.0031	.880	.112	.150	-1.402	36.594	4.491	5.933	.864
B/R	.0025	.929	.146	-.033	1.423	42.462	6.419	-1.426	.888

Table 39: Size-Value Sorted Portfolios

Portfolio	**Alpha**	**Beta1**	**Beta2**	**Beta3**	**T-Value**	**T-value1**	**T-value2**	**T-value3**	**Adjusted R^2**
S/L	-.0017	.808	.445	-.143	-.598	30.905	16.332	-5.201	.840
S/M	-.0022	.773	.440	.103	-1.009	35.593	19.459	4.517	.889
S/H	-.0012	.705	.474	.245	-.641	43.182	27.893	14.278	.938
B/L	-.0009	.941	.149	-.083	-.566	45.604	6.953	-3.842	.900
B/M	-.0010	.864	.108	.187	-.436	35.167	4.206	7.246	.858
B/H	-.0008	.768	.069	.396	-.303	30.866	2.667	15.152	.855

Table 40: Size-Momentum Sorted Portfolios

Portfolio	**Alpha**	**Beta1**	**Beta2**	**Beta3**	**T-Value**	**T-value1**	**T-value2**	**T-value3**	**Adjusted R^2**
S/L	-.0013	.720	.406	.196	-4.308	27.742	15.017	7.184	.842
S/W	.0094	.597	.441	.108	2.287	15.158	10.744	2.619	.636
B/L	-.0035	.711	.089	.223	-.860	17.711	2.116	5.291	.622
B/W	.0060	.685	.141	.000	1.586	14.752	2.908	.008	.494

Thereafter, the double-sorted portfolios are then regressed against the Fama-French Three-Factor model. In comparison to the CAPM, the Three-Factor model does a better job at explaining the excess returns of the double-sorted portfolios. The model is able to explain the mean-excess returns for all but two of the double-sorted portfolios. Only the portfolios S/R, comprising of small cap stocks having high profitability, and S/W, which consists of small cap stocks having strong momentum effects, display statistically significant Alpha-intercepts. The values of the adjusted R-squared are also much higher than those observed for the single-index CAPM, which suggests that the Fama-French Three-factor model is more adept at explaining the excess portfolio returns. So far, one of the common threads being observed is that most of the portfolios that have outperformed the models being tested generally comprise of small stock companies. Additionally, both the single-index model and the three-factor model do not sufficiently explain the mean excess returns of portfolios which consist of past winners.

Carhart Four-Factor model

$$R_{pt} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_{it} + \beta_3 MOM_{it} + \varepsilon_{it}$$

Table 41: Size-Investment Sorted Portfolios

Portfolio	Alpha	Beta 1	Beta 2	Beta 3	Beta 4	T-Value A	T-value 1	T-value 2	T-value 3	T-value 4	Adjusted R^2

S/C	-.0026	.682	.482	.182	-.101	-1.281	37.271	26.538	9.593	-5.333	.929
S/M	.0013	.729	.454	.105	-.107	.630	36.230	22.725	5.062	-5.131	.914
S/A	.0061	.743	.426	.042	-.141	2.526	33.049	19.070	1.813	-6.043	.892
B/C	-.0005	.802	.126	.190	-.134	-.224	32.140	5.092	7.357	-5.198	.868
B/M	.0016	.846	.102	.117	-.133	.827	36.220	4.389	4.833	-5.485	.884
B/A	.0038	.891	.144	-.077	-.134	1.928	41.498	6.779	-3.477	-5.998	.902

Table 42: Size-Profitability Sorted Portfolios

Portfolio	**Alpha**	**Beta1**	**Beta2**	**Beta3**	**Beta4**	**T-Value**	**T-value1**	**T-value2**	**T-value3**	**T-value4**	**Adjusted R^2**
S/W	-.0027	.721	.463	.118	-.119	-1.295	40.272	26.055	6.357	-6.400	.932
S/M	.0006	.703	.460	.151	-.101	.288	34.355	22.661	7.120	-4.782	.911

S/R	.0094	.725	.446	.071	-.119	4.007	30.869	19.148	2.918	-4.891	.883
B/W	-.0000	.835	.115	.135	-.134	-.011	35.538	4.931	5.570	-5.511	.883
B/M	.0004	.832	.114	.108	-.163	.220	35.972	4.947	4.508	-6.803	.886
B/R	.0043	.900	.147	-.058	-.098	2.493	40.584	6.677	-2.524	-4.262	.895

Table 43: Size-Value Sorted Portfolios

Portfolio	**Alpha**	**Beta1**	**Beta2**	**Beta3**	**Beta4**	**T-Value**	**T-value1**	**T-value2**	**T-value3**	**T-value4**	**Adjusted R^2**
S/L	.0027	.758	.446	-.187	-.171	1.00	29.923	17.748	-7.124	-6.509	.864
S/M	.0008	.735	.441	.070	-.128	.405	34.389	20.792	3.166	-5.784	.903

S/H	.0012	.679	.475	.222	-.088	.645	41.744	29.420	13.200	-5.192	.944
B/L	.0012	.908	.150	-.112	-.111	.730	44.197	7.366	-5.261	-5.231	.910
B/M	.0026	.817	.109	.146	-.161	1.176	34.337	4.605	5.913	-6.535	.880
B/H	.0035	.720	.070	.354	-.164	1.323	29.907	2.939	14.204	-6.565	.877

Table 44: Size-Momentum Sorted Portfolios

Portfolio	**Alpha**	**Beta1**	**Beta2**	**Beta3**	**Beta4**	**T-Value**	**T-value1**	**T-value2**	**T-value3**	**T-value4**	**Adjusted R^2**
S/L	-.595	.645	.408	.130	-.257	-2.347	29.288	18.675	5.697	-11.274	.897

S/W	-.0007	.717	.439	.213	.408	-.209	22.032	13.574	6.328	12.089	.775
B/L	.0021	.643	.090	.163	-.233	.536	16.218	2.289	3.978	-5.682	.666
B/W	-.0030	.823	.138	.121	.469	-.979	21.118	3.562	2.996	11.599	.677

When the mean-excess returns for the double sorted portfolios are regressed against the Carhart Four-Factor model, which is simply the Fama-French Three-Factor model with an added Momentum factor, some interesting results come to the fore. First, the Four-Factor model is tested by regressing the returns for portfolios sorted on the basis of size and investment effects against it. It is found that the portfolios S/A and B/A, comprising of small size and big size companies aggressively investing in assets, have statistically significant Alpha-intercepts at 5 percent and 10 percent confidence intervals. Thereafter, returns for portfolios sorted on the basis of size and profitability factors are regressed against the Carhart Four-Factor model. It is similarly found that the portfolios S/R, consisting of small size companies with robust profitability, and B/R, consisting of big sized companies with robust profitability, outperform the model when viewed in terms of the statistically significant Alpha-intercepts that are observed. Portfolios formed on the basis of Size and Value factors do not outperform the model as these effects are already subsumed in the factors that comprise the model. Similarly, portfolios formed on the basis of size and momentum effects also do not display statistically significant Alpha-intercepts for reasons similar to those mentioned previously. Furthermore, it is even more interesting to note that when portfolios formed using the Size and Value effects are tested against the Carhart, the Beta Co-efficient for the size and value effects are high and strong in terms of their statistical significance. However, the Beta Co-efficient for the momentum factor is extremely feeble. This is especially true in case of the portfolio S/H, which

consists of small-size, high-value companies. On the other hand, portfolios formed on the Size and Momentum effects have statistically significant Beta Co-efficients not just for the momentum factor, but also for the size and value factors as well. These observations would seem to suggest the presence of a reversal effect, as that would be an appropriate explanation for the aforementioned observations.

Fama-French Five-Factor Model

$$R_{pt} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + + \beta_4 CMA_t + \beta_5 RMW_t + \varepsilon_{it}$$

Table 45: Size-Investment Sorted Portfolios

Portfolio	A	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
S/C	.0064	.682	.453	.083	-.129	-.106	.322	34.008	26.212	3.633	-5.799	-4.591	.938
S/M	-.0002	.729	.447	.125	.026	-.060	-.094	29.390	20.953	4.456	.956	-2.118	.906

S/A	.00123	.707	.431	.166	.202	-.103	.493	27.481	19.473	5.672	7.075	-3.505	.899
B/C	.00109	.826	.099	.101	-.143	-.080	.432	28.277	3.936	3.059	-4.399	-2.377	.869
B/M	.0003	.855	.092	.127	.003	-.064	.154	29.443	3.683	3.846	.078	-1.917	.871
B/A	.0005	.867	.146	.012	.143	-.090	.244	33.802	6.602	.415	5.030	-3.072	.899

Table 46: Size-Profitability Sorted Portfolios

Portfolio	α	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
S/W	.0002	.663	.434	.069	.003	-.202	.098	33.691	25.633	3.105	.151	-8.932	.941
S/M	-.00003	.707	.450	.145	-.012	-.059	-.011	28.261	20.874	5.106	-.446	-2.062	.904
S/R	.0028	.804	.465	.170	.038	.109	1.138	28.562	19.170	5.313	1.226	3.386	.878
B/W	.0031	.745	.082	.093	.047	-.265	1.315	29.462	3.744	3.250	1.684	-9.148	.902
B/M	-.0009	.831	.100	.120	.016	-.099	-.415	28.363	3.969	3.615	.502	-2.944	.868
B/R	.0004	.963	.160	.012	.020	.080	.262	36.073	6.952	.403	.675	2.615	.891

Table 47: Size-Value Sorted Portfolios

Portfolio	α	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
S/L	.0031	.713	.422	-.196	.040	-.194	1.053	23.339	16.039	-5.638	1.170	-5.539	.857
S/M	-.0006	.753	.432	.075	-.013	-.048	-.282	28.092	18.730	2.467	-.450	-1.568	.890
S/H	.0011	.665	.464	.218	.010	-.082	.552	33.748	27.320	9.724	.441	-3.645	.940
B/L	.0001	.909	.142	-.098	.018	-.064	.082	35.825	6.517	-3.386	.639	-2.203	.901
B/M	.0005	.821	.099	.171	.029	-.084	.231	27.243	3.807	5.010	.862	-2.440	.861
B/H	.0029	.686	.051	.362	.049	-.161	.998	23.269	2.027	10.817	1.499	-4.767	.867

Table 48: Size-Momentum Sorted Portfolios

Portfolio	**α**	**β1**	**β2**	**β3**	**β4**	**β5**	**T α**	**T1**	**T2**	**T3**	**T4**	**T5**	**Adj. R^2**
S/L	-.0078	.628	.382	.137	.028	-.191	-2.519	20.698	14.624	3.969	.819	-5.471	.859
S/W	.0127	.542	.424	.059	-.002	-.120	2.891	11.195	10.166	1.070	-.036	-2.161	.640
B/L	.0020	.576	.060	.171	.086	-.267	.468	12.120	1.465	3.172	1.638	-4.892	.654
B/W	.0086	.655	.123	-.068	-.056	-.082	2.122	11.434	2.496	-1.050	-.876	-1.254	.496

Returns of the double-sorted portfolios are then regressed against the Fama-French Five-Factor model, which consists of Investment and Profitability factors in addition to the three factors from the earlier model proposed by Eugene Fama and Kenneth French. It is intriguing to note that despite the fact that the Five-Factor model consists of an Investment factor, the Size and Value effects still carry significant explanatory power when concerned with the excess returns of portfolios formed on the size-investment sorts. This is found to be especially true for all three small size portfolios S/C, S/M and S/A.The Investment factor only carries statistically significant explanatory power in case of the portfolios S/A and B/A, which comprise of companies that are investing aggressively in assets. A similar trend can be observed when the returns for portfolios formed on the Size-Profitability sorts are regressed against the Five-Factor model. The Size and Value effects display statistically significant power in explaining the excess returns of all the small size portfolios S/W, S/M and S/R. The Profitability effect only helps explain the returns of portfolios S/R and B/R, which consists of companies that have robust profitability. The Alpha-intercepts of portfolios formed on the Size-Investment, Size-Profitability and Size-Value sorts are statistically insignificant, implying that the Five-Factor model does a fair job of explaining the returns of the aforementioned double-sorted portfolios. However, for portfolios sorted on the Size-Momentum factors, the Alpha-intercepts for the portfolios S/W and B/W, consisting of small size winners and big size winners respectively, are statistically significant. Moreover, the T-values for the Beta Co-efficients related to the

Market and Size effects, while still statistically significant, show a sharp drop in case of both the Winner portfolios. Additionally, the values of the adjusted R squared are also lower than those observed for the model when testing against the other double-sorted portfolios. These observations, when summed up, would seem to suggest that the Five-Factor model is not as robust when explaining the excess returns on portfolios having strong Momentum effects.

Modified Five-Factor Model

$$R_{pt} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 CMA_t + \beta_4 RMW_t + \beta_5 MOM_{it} + \varepsilon_{it}$$

Table 49: Size-Investment Sorted Portfolios

Portfolio	A	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
S/C	.0045	.665	.460	-.172	-.097	-.107	2.505	34.547	28.203	-9.623	-4.476	-6.377	.945
S/M	.0046	.711	.458	-.039	-.060	-.117	2.134	28.878	21.963	-1.697	-2.170	-5.450	.909
S/A	.0077	.685	.445	.116	-.107	-.142	3.273	26.752	20.515	4.880	-3.705	-6.385	.902
B/C	.00551	.802	.108	-.195	-.064	-.147	2.381	28.604	4.536	-7.495	-2.036	-6.013	.882
B/M	.0046	.832	.103	-.063	-.056	-.143	2.285	29.399	4.286	-2.405	-1.766	-5.821	.880
B/A	.0023	.847	.148	.137	-.059	-.117	1.236	34.663	7.129	6.051	-2.167	-5.496	.911

Table 50: Size-Profitability Sorted Portfolios

Portfolio	A	β1	β2	β3	β4	β5	T α	T1	T2	T3	T4	T5	Adj. R^2
S/W	.0038	.646	.440	-.033	-.190	-.104	2.096	34.462	27.735	-1.873	-9.026	-6.381	.947

S/M	.0052	.690	.462	-.088	-.064	-.116	2.380	27.344	21.614	-3.745	-2.274	-5.290	.905
S/R	.0091	.780	.479	-.050	.109	-.155	3.869	28.066	20.338	-1.929	3.495	-6.425	.884
B/W	.0072	.727	.089	-.001	-.257	-.113	3.245	29.390	4.268	-.047	-9.277	-5.246	.908
B/M	.0038	.840	.110	-.046	-.082	-.167	1.789	28.991	4.702	-1.783	-2.646	-6.944	.885
B/R	.0019	.944	.161	.014	.109	-.108	1.147	36.661	7.402	.583	3.757	-4.843	.901

Table 51: Size-Value Sorted Portfolios

Portfolio	**α**	**β1**	**β2**	**β3**	**β4**	**β5**	**T α**	**T1**	**T2**	**T3**	**T4**	**T5**	**Adj. R^2**
S/L	-.00003	.689	.407	.142	-.107	-.116	-.009	21.690	15.157	4.813	-3.009	-4.203	.849
S/M	.0031	.731	.439	-.052	-.029	-.134	1.413	28.603	20.282	-2.20	-1.019	-6.025	.902
S/H	.0087	.650	.481	-.104	-.109	-.109	4.086	29.340	25.631	-5.029	-4.395	-5.649	.926
B/L	-.0006	.891	.135	.069	-.012	-.088	-.374	35.049	6.288	2.925	-.417	-3.985	.903
B/M	.0068	.794	.113	-.060	-.080	-.174	2.903	27.110	4.560	-2.210	-2.421	-6.849	.872
B/H	.0155	.659	.081	-.139	-.202	-.195	4.926	19.685	2.840	-4.478	-5.378	-6.686	.832

Table 52: Size-Momentum Sorted Portfolios

Portfolio	**α**	**β1**	**β2**	**β3**	**β4**	**β5**	**T α**	**T1**	**T2**	**T3**	**T4**	**T5**	**Adj. R^2**
S/L	.00015	.587	.394	-.043	-.154	-.252	.060	23.068	18.310	-1.824	-5.379	-11.40	.903
S/W	.0079	.616	.426	-.034	-.257	.413	2.401	16.191	13.221	-.953	-6.026	12.497	.783

B/L	.0094	.540	.074	-.002	-.248	-.221	2.363	11.701	1.905	-.051	-4.785	-5.513	.681
B/W	.00166	.739	.115	-.021	-.206	.485	.538	16.336	2.997	-.510	-4.064	12.333	.693

In accordance with the argument of Fama and French (2015), that the addition of a profitability factor to the Three-Factor model renders the Value effect as obsolete, the study then evaluates the efficacy of a modified Five-Factor model that does away with the Value factor but adds a Momentum factor in its place. All the other factors which are part of the Fama-French Five-Factor model are still in place. The study finds statistically significant Alpha-intercepts for all but one of the portfolios sorted on the basis of the Size-Investment effects. Similarly, only the portfolio B/R, which comprises of Big sized companies with robust profits, does not have a statistically significant Alpha-intercept. For portfolios sorted on the Size and Value effects, the portfolios S/H, comprising of small-sized high-value companies, the portfolios B/M and B/H, comprising of big companies with moderate value and high value respectively, also outperform the model at a statistically significant level. Surprisingly, for a model that has the Momentum effect as one of its constituents, even the portfolios sorted on Size-Momentum factors display statistically significant Alpha-intercepts. The portfolio S/W, comprising of small-sized winners, shows statistically significant outperformance while at the same time having a Beta Co-efficient for the Momentum factor which also has a statistically significant value. Surprisingly, even the portfolio B/L, comprising of big-sized losers, also shows a statistically significant Alpha-intercept. The observations related to the testing of portfolios sorted on the basis of the Size-Momentum effects would suggest the presence of a momentum effect in security returns, while at the same time making a case for the Value effect as well.

Six-Factor model

$$R_{pt} - R_{ft} = \alpha_{it} + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 CMA_t + \beta_5 RMW_t + \beta_6 MOM_{it} + \varepsilon_{it}$$

Table 53: Size-Investment Sorted Portfolios

P	α	β1	β2	β3	β4	β5	β6	T α	T1	T2	T3	T4	T5	T6	Adj. R^2
S/C	.0029	.665	.455	.059	-.14	-.083	-.098	1.516	35.028	28.142	2.701	-6.750	-3.811	-5.831	.946
S/M	.0019	.711	.450	.100	.014	-.037	-.102	.873	29.661	22.034	3.663	.512	-1.344	-4.794	.914
S/A	.0039	.686	.434	.136	.187	-.076	-.122	1.654	28.046	20.857	4.851	6.920	-2.687	-5.641	.910
B/C	.0038	.803	.102	.068	-.16	-.049	-.137	1.570	28.836	4.323	2.134	-5.204	-1.517	-5.542	.884
B/M	.0025	.833	.095	.095	-.01	-.035	-.129	1.219	29.914	4.023	2.987	-.445	-1.077	-5.242	.884
B/A	.0027	.847	.149	-.02	.128	-.063	-.119	1.367	34.612	7.145	-.615	4.755	-2.247	-5.505	.910

Table 54: Size-Profitability Sorted Portfolios

P	α	β1	β2	β3	β4	β5	β6	T α	T1	T2	T3	T4	T5	T6	Adj. R^2
S/W	.00253	.646	.437	.046	-.01	-.18	-.097	1.297	34.740	27.571	2.139	-.434	-8.379	-5.905	.948
S/M	.00207	.691	.452	.121	-.02	-.04	-.098	.911	28.405	21.852	4.353	-.921	-1.318	-4.561	.911
S/R	.00566	.781	.468	.137	.021	.140	-.135	2.341	29.216	20.566	4.471	.725	4.548	-5.708	.893
B/W	.00541	.727	.084	.068	.034	-.24	-.103	2.304	29.714	4.036	2.433	1.273	-8.585	-4.742	.910

B/M	.0019	.805	.104	.082	-.00	-.06	-.155	.855	29.371	4.461	2.622	-.104	-2.019	-6.404	.887
B/R	.0022	.944	.163	-.01	.006	.105	-.111	1.248	36.598	7.403	-.507	.216	3.541	-4.843	.900

Table 55: Size-Value Sorted Portfolio

P	α	β1	β2	β3	β4	β5	β6	T α	T1	T2	T3	T4	T5	T6	Adj. R^2
S/L	.0064	.687	.425	-.23	.021	-.160	-.15	2.290	23.778	17.296	-7.035	.654	-4.806	-5.872	.875
S/M	.0019	.731	.435	.044	-.03	-.019	-.13	.847	28.691	20.069	1.504	-1.045	-.657	-5.645	.903
S/H	.0029	.652	.466	.198	.000	-.064	-.08	1.517	34.127	28.645	9.074	-.016	-2.926	-4.712	.945
B/L	.0019	.890	.145	-.12	.005	-.040	-.10	1.076	36.375	6.957	-4.417	.173	-1.417	-4.904	.910
B/M	.0035	.795	.103	.133	.009	-.049	-.15	1.490	28.050	4.258	4.120	.302	-1.509	-6.166	.880
B/H	.0062	.661	.055	.326	.031	-.128	-.15	2.248	23.730	2.326	10.242	.999	-3.989	-5.939	.884

Table 56: Size-Momentum Sorted Portfolio

P	α	β1	β2	β3	β4	β5	β6	T α	T1	T2	T3	T4	T5	T6	Adj. R^2
S/L	-.002	.587	.388	.078	-.003	-.136	-.24	-.828	23.398	18.173	2.708	-.094	-4.701	-10.833	.906
S/W	.0035	.617	.413	.166	.053	-.219	.438	1.050	16.716	13.140	3.942	1.301	-5.163	13.394	.796
B/L	.0062	.541	.065	.121	.061	-.220	-.20	1.497	11.827	1.670	2.316	1.207	-4.184	-5.022	.687
B/W	.0005	.740	.111	.053	.006	-.194	.493	.175	16.345	2.875	1.019	.121	-3.730	12.302	.693

The double-sorted portfolios are then regressed against a six-factor model that also incorporates a Momentum factor in addition to the five factors as proposed by Fama-French. Among the portfolios sorted on the basis of size-investment effects, only the portfolio S/A, consisting of small-sized companies which are aggressively investing in assets, shows a statistically significant Alpha-intercept at the 10 percent confidence interval. The Market and Size factors have a statistically significant impact on the mean-excess returns of the size-investment sorted portfolios. The Value effect also has a significant impact, from a statistical standpoint, on the returns of all of the size-investment portfolios except for the portfolio B/A, consisting big-sized companies which are aggressively investing in assets. For portfolios sorted on the basis of the Size and Profitability effects, the portfolios S/R, consisting of small-sized companies with robust profits, and, somewhat surprisingly, B/W, comprising of big-sized companies with weak profits, show statistically significant Alpha-intercepts. In case of portfolios sorted on the basis of Size and Value effects, only the portfolios S/L and B/H, small-sized low-value companies and big-sized high-value companies respectively, show statistically significant Alpha-intercepts. The addition of a momentum effect to the Fama-French five factors seems to have subsumed the excess returns of the portfolios sorted on the Size-Momentum effects, which was evident in the earlier tests. The sum total of all these observations would indicate that momentum has to be taken into consideration when explaining portfolio returns.